Water and Turf: Fluoridation and the 20th-Century Fate of Waterworks Engineers

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ABSTRACT

Once central figures in American public health, waterworks engineers are no longer involved in many decisions made about the public water supplies. This paper argues that the profession's response to the early fluoridation movement of the 1940s and 1950s marked a change in the relationship between waterworks engineers and the other constitutive groups in public health and contributed to the disenfranchisement of the waterworks profession. Sensing a potentially divisive issue, two leaders of the profession, Abel Wolman and Linn Enslow, took steps they hoped would prevent a rift within the profession and allow waterworks engineering to continue its association with the wider public health community. Although the leaders saw the fluoridation issue differently, neither encouraged the profession to consider it openly or to take up the broader question of what limits, if any, should be placed on treating water supplies to meet human needs. Instead, they opted to locate authority for fluoridation outside the waterworks profession with dentists, doctors, and public health administrators. As a result, waterworks engineers conceded a great deal of the status and prestige associated with decision-making roles in community health issues and have largely faded from view. (*Am J Public Health.* 1996;86: 1310–1317)

Introduction

When the city of San Francisco passed a water fluoridation initiative in 1951 after a lengthy public debate, the *Journal of the American Water Works Association* reported a victory for the forces of progressive public health. Pro-fluoridationists had "prevailed," according to the Journal, "apparently convincing a majority of voters that fluoridation was neither 'mass medication' nor 'unsound economics. . . . And," concluded the report, "you can put that in your pipes or provoke it."[1]

For several years preceding the San Francisco decision, opposition to and uncertainty about water fluoridation threatened to divide the ranks of professional waterworks engineers. Worse, such responses threatened to separate the engineers from other leading constituent groups in public health—notably doctors, dentists, and public health administrators—who were emerging as supporters of water fluoridation. Concerned that infighting or deviation from the rest of the public health community would result in a loss of professional status, leaders of the American Water Works Association had worked diligently to ensure that—given the choice of quietly putting fluoridated water in their pipes or further provoking the issue—their constituents would stand united with others in the public health community on what has often been called one of the greatest public health campaigns of the 20th century. The efforts of association leaders seemed to pay off: by the late 1960s, dissent had largely died out among waterworks engineers, and in fact, the association had come to be widely regarded as a leader in the fluoridation movement, "one of the first organizations to accept a major role in safeguarding the Nation's dental health," according to a 1970 U.S. Public Health Service publication.[2]

From a current vantage point, however, the association's success in quelling member dissent over the issue of fluoridation provides little reason for waterworks engineers to smile: if the waterworks profession won the battle in achieving the support of its professional association for water fluoridation, it lost the war to maintain close association with the wider public health movement, and perhaps more critically, the profession lost its key role in decisions about public water supplies. Waterborne disease and chemical pollution remain major public health problems, but large-scale and long-term responses to them, which once fell to waterworks engineers, now fall to environmental scientists, epidemiologists, and other public health professionals. In the main (as it were), waterworks engineers today simply add the chemicals, watch the dials, and clean up the mess.

The story of how waterworks engineers responded to the fluoridation debate of the 1940 and 1950s, then, is in part a story of the lifespan of a public health profession and an account of how a political battle silenced a once-active voice in community health issues. More important, however, it illustrates how conservative professional strategies can backfire in the increasingly politically charged world of public health of the late 20th century.

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Building a Profession

Civil, mechanical, and hydraulic engineers have been designing and building municipal waterworks since the late 18th century, but it was not until the late 19th century and the advent of the Progressive public health movement that waterworks engineering emerged as a separate profession. As the new movement took shape, aimed largely at eliminating crowded tenements, unhealthy food, and contaminated water, individual engineers began to make careers exclusively in supplying—and supplying advice on how to get—clean water. Opportunity abounded. Between 1880 and 1900, 3350 public water supplies were developed in the United States and Canada, most of them municipally owned; from 1893 to 1897 alone, some 1400 municipal waterworks were constructed.[3]

By the turn of the century, waterworks engineers formed the core of a profession focused on water supply. Programs of study and research initiatives devoted to the specific challenges of water supply sprang up in many universities in both schools of engineering and schools of hygiene or public health. Two national professional organizations emerged in the decades before the turn of the century: the American Water Works Association (founded 1881) and the New England Water Works Association (1882). Each held well-attended national meetings, was affiliated with a growing number of regional sections, and had a respected monthly journal whose readership included members of the general public health community.

From its inception, in fact, waterworks engineering maintained at least as many ties to the professional structures of public health as it had to any of the other branches of engineering. Waterworks and sewage engineers (sometimes known under the collective banner of "sanitary engineers")[4] perceived themselves to be founding members of the public health community and thus participated actively in public health professional activities.[5] Rudolph Hering, a sanitary engineer who had been instrumental in developing water supplies for several major cities over the previous 30 years, served as the president of the American Public Health Association in 1913, only the second nonphysician to do so, and sanitary or waterworks engineers filled that position again in 1915 and 1939. Waterworks engineers frequently put their bureaucratic talents—or political aspirations—to work in state and local health departments, in the Public Health Service, and in other federal agencies. They built coalitions with other public health professionals, particularly in infrastructure projects here and abroad, which brought them together with doctors, chemists, bacteriologists, and administrators. In projects ranging from the development of drinking water systems for railway cars to canal construction in areas where both fever and flood were common, waterworks engineers cemented their relationship with the broader public health community.

Concurrent with, and more important than, building these ties and erecting the structures of a profession—the associations, journals, schools, and codes that are the hallmarks of professionalization—waterworks engineers in the decades around the turn of the century were also attempting to stake out for themselves an area of exclusive professional authority.[6] They saw themselves, and hoped others would see them, as sole and rightful experts on all questions, big and small, pertaining to a commodity of increasing social importance: the public water supply. They spoke out, not just on technical questions but also on issues of policy concerning the water supply. And they established their relationship with the public and rest of the public health community not by always agreeing with the other voices in public health, physicians in particular, but, as Joel Tarr has noted, by acting on what they believed constituted the "uniqueness of their field and its special role within public health."[7]

To be sure, not every waterworks professional was a public health activist or indeed an activist of any sort.[8] As did every middle-class profession, waterworks engineering attracted people of a variety of personal aspirations, including those merely seeking "the warm burrow of the mid-level civil servant."[9] But while individual career security may be a matter of finding a comfy berth and settling in, the security of entire professions always depends on a more active stance, aimed at maintaining exclusive authority over the profession's jurisdiction.[10] Nor is professional leadership any job for the lazy, given interprofessional competition for status and resources, evolving professional knowledge and practice, and changing social and economic circumstances.

New Opportunities

As the 19th century yielded to the 20th—and, more important, as the privy vault system was supplanted by sewage lines that dumped into rivers, lakes, and bays around the country—waterworks engineering was presented with new opportunities to expand its authority over the public water supplies. With rates for dysenteries, cholera, and especially typhoid fever soaring at many downstream locations, the profession shifted its focus from issues of "capacity and purveyance" (as Colleen O'Toole has described the central concern of water supply in the 19th century), first to the question of watershed protection and then to the development of techniques to disinfect water.[11] Filtration and chemical disinfection systems, widely adopted across the country between 1910 and 1930, lowered the instance of waterborne illness even as they raised the standing of the profession in the eyes of the public and the public health community.

In conjunction with and following the success of decontamination, waterworks engineers also began to develop techniques for making water look, smell, and taste better and for making it chemically "softer." These developments generally earned them great favor among water consumers, now accustomed to "refinements of living undreamed of by their ancestors [and inclined to] kick if water has excessive hardness, is perceptibly colored, corrodes [their] plumbing equipment or causes stain on the porcelain fixtures and clothes in the laundry."[12]

An increase in professional status rarely comes without risk, however, and the waterworks profession also faced public controversy for the first time as it delved into the arena of water treatment. Charges of "doping the water supply" sporadically followed the use of almost any chemical in water treatment, and not surprisingly, the public was especially chary of the use of chemicals with known toxic properties, including alum (used as a coagulant) and chlorine.[13]

Waterworks engineers, wrestling for the first time with what we would now call public relations problems, sometimes defended contemporary techniques by attacking the colloquial understanding of water "purity."[14] "Purifying" water, which is how many waterworks engineers described their own work, was not a matter of returning water to its primeval state or of rendering it chemically pure, but of making water harmless to people.[15] However, and especially before 1910, they also struggled with the question of whether "pure water is better than a purified water," as George Fuller put it, or, as

another engineer, E. Sherman Chase, cast the issue, whether "innocence is better than repentance."[16]

Although most waterworks engineers supported the particular water treatments devised in the opening decades of the 20th century, the idea of treating water to suit human health needs raised questions about what limits there were or ought to be in water treatment. For example, diffuse but serious interest in the use of the water supply to provide nutrients to people arose in the 1920s, an outgrowth of the great interest in the many ongoing nutrition studies and experiments of the time. A handful of water treatment plants seriously considered the addition of iodine to public water supplies as a goiter preventive—and three waterworks in this country actually undertook iodization—but the idea never caught on. In fact, in only one city, Rochester, N.Y., did iodization last more than a few months and there only "out of respect for the long-continued able service [of the city's health officer] and his winsome personality."[17]

Accounts of water iodization usually attribute the idea's failure to technical concerns, especially dosage control, as well as to issues of "cost, waste, offensive taste, [and] undesirable chemical combinations."[18] But almost certainly more was involved, including public fears and reluctance among waterworks engineers to take on an additional workload. Moreover, water iodization's failure was the table salt industry's success. Salt manufacturers were persuaded where the waterworks profession was not—namely, that there was value in giving the public what it wanted, and much of the public wanted iodine.[19]

Iodized salt solved the problem of where consumers could get a widely touted mineral, but waterworks engineers were left with the question of how far the profession should go to produce water that suited human health needs. The question was still on the table a decade later when the waterworks profession began to consider adding fluoride to water. As with iodization, the idea of artificially fluoridating water came from outside the waterworks profession although waterworks engineers had for some time been aware of the suspected properties of fluoridated water.

In the 1920s, fluorine, which occurs naturally in water, was one of several elements suspected of causing pitted and discolored teeth that were common in certain areas of the country, especially the West, and it came to the attention of waterworks engineers as a nuisance rather than a benefit.[20] Engineers followed the investigation of the mottled teeth from the 1920s, before the cause was determined. Several waterworks engineers supported Frederick McKay, the Colorado dentist who had devoted much of his career to investigating the problem, in his efforts to get the Public Health Service involved.[21] Others responded to an article McKay published in 1926 in *Water Works Engineering* with suggestions for the cause of the disfigurement, including fluorine deficiency.[22] In 1931 two teams of chemists working in Arkansas and Arizona confirmed a connection between excessive fluorine and mottled enamel. The same year, H. Trendley Dean, a dentist from the Public Health Service's newly established National Institute of Health (NIH), was dispatched from the San Francisco office to look into the problem, and investigating fluoride became the first dental research project of the NIH and the cornerstone of many university-based dental research programs as well. After fluoride was identified as the cause of the disfigurement, waterworks engineers and chemists worked to develop methods for measuring fluoride quickly and accurately and to devise inexpensive defluorination techniques. In 1936 the American Water Works Association appointed a committee to evaluate fluoride measurement techniques, prepare a bibliography, and report on their findings. The committee's chair was Alvin P. Black, an agricultural chemist who was preparing a survey of fluoride in Florida waters.

Even after the mystery of the brown stain was solved and methods were in place for measuring and eliminating fluoride, another link between fluoride and tooth enamel continued to interest the dental community. Investigators of the disfigured teeth had long observed that these teeth seemed less susceptible to tooth decay than did teeth unaffected by fluoride. Their observations, unconfirmed for years, nevertheless galvanized the dental community with the hope of a dental magic bullet, something akin to a vitamin against tooth decay, a hope conditioned by near-daily "discoveries" of vital nutrients and their properties. In 1937 Dean began to investigate the link between fluoride and cavity-free teeth under Public Health Service auspices, comparing the incidence of decay in towns with naturally high water fluoride levels against decay rates in towns whose water was low in fluoride. These comparisons led Dean to confirm a relationship between fluoride and lowered decay in 1939 and, in 1942, to establish 1 ppm of fluoride in water as an efficacious level that would not induce mottling.[23]

Artificial Fluoridation Begins

Between 1938 and 1942, Dean and several other researchers conceived of the idea of artificially fluoridating water to prevent tooth decay.[24] Gerald Cox, a nutrition researcher at the Mellon Institute, initially presented the idea to waterworks engineers in 1939, telling an association section meeting that "treatment of water supplies by the addition of fluorides in most cases offers the most practical means of approaching the goal of sound teeth for all children—truly a mass prevention of dental caries." There were surely those present at the talk who wanted to seize the opportunity Cox seemed to be offering the profession, including those who may have begun to see the failure of iodization as a lost opportunity for good public relations. But Harry Jordan, association secretary and a prominent figure in the water supply field, responded to Cox's talk by urging caution about how far water treatment should be carried to meet human needs: "Water works engineers need the evidence of wide research along with medical and dental approval before they are led into mass medication through public water supplies."[25]

Caution was to characterize the response of the waterworks profession to fluoridation proposals for the next several years. Indeed, although support mounted among dentists and some segments of the public for trials using artificially fluoridated water, waterworks engineers had little to say publicly on the issue and did not discuss it at their national meeting until 1943, when two major clinical trials of artificially fluoridated water were already being planned. That year association members heard several speakers in a panel on fluoride. Dean, who in 1944 would begin a trial between the cities of Grand Rapids and Muskegon, Mich., gave an overview of fluoride research to date, stressing the results of the controlled comparisons using the naturally fluoridated water of cities in Illinois. David B. Ast of the New York State Department of Health outlined the proposed clinical trial of artificial fluoridation set to begin in the cities of Newburgh and Kingston, and Harold Knapp, health commissioner of Cleveland, spoke on dental deficiencies as a public health problem.[26]

The only waterworks engineer on the panel was Abel Wolman, whose term as American Water Works Association president was ending with the 1943 meeting. Wolman, chairman of the Department of Sanitary Engineering at Johns Hopkins University with a joint appointment in the School of Engineering and the School of Hygiene and Public Health, had already earned a name for himself in public health circles, having served as American Public Health Association (APHA) president in 1939 and as associate editor of the *American Journal of Public Health,* as well as advisor to the surgeon general and several state and international governments. Wolman's approach to public health and water supply issues was thoughtful, even philosophical, and he also paid very conscious attention to the well-being and advancement of the waterworks profession. He referred frequently to historical precedent set by the profession and often wrote on broad issues, such as the role of the engineer in society and the contributions of engineering to public health. An eloquent speaker and writer, Wolman had already taken water supply issues, especially pollution reform and the question of a national water policy, to a much wider audience through radio and magazine interviews.[27] His many accomplishments, his broad perspective, and his rapport with the public caused waterworks engineers to look on him with a respect bordering on awe. On a questionnaire distributed by APHA in 1940, a West Virginia waterworks engineer volunteered a testimonial to Wolman: "We note the name of the revered Abel Wolman on your letterhead and wish to advise that water works men throughout the nation regard him as a leader in the field."[28]

Wolman's 1943 talk, "What Are the Responsibilities of Public Water Supply Officials in the Correction of Dental Deficiencies?" was characteristic of his style.[29] While he echoed the cautious sentiments that secretary Harry Jordan had put forth 4 years earlier, Wolman took his analysis much deeper, encouraging waterworks personnel to look to the profession's past for guidance in responding to proposals to fluoridate community water supplies. He cited earlier efforts to chlorinate water, in which he had been instrumental, as instances in which the profession was prepared to face controversy to bring the public better water. "We had an amazing set of controversies, which ran all through the courts, through most of the medical associations, and all of the engineering associations, in order to prove again that the balance was in favor of, and not against, the public."[30]

But Wolman sensed something different, "in a subtle but important way," about the proposal to add fluoride to water supplies. He noted that previous modifications to the water were intended "to *eliminate* products from water rather than to *introduce* new complexes of a chemical or biological nature" [emphasis added]. Although Wolman said he saw chemical additions to water as "part of an evolutionary process ... [to] raise the general level of the public health of the community," he also stated that he felt suggestions to fluoridate water were premature at best. "I am not ready to move toward any suggestion that in practice we should go all the way [and fluoridate water supplies] in light of our present evidence."[31] He then concluded, "this is not the day on which to press the water works operator to an acceptance of this proposal."[32]

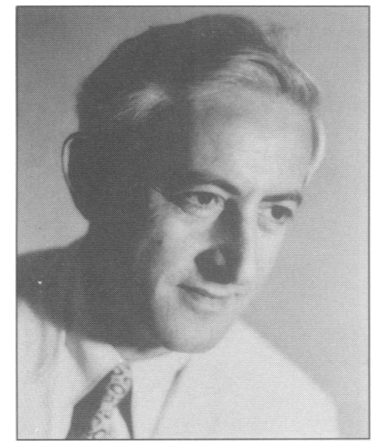
In fact, several years were to pass before waterworks engineers were to be pressed on the issue of artificial fluoridation of water, and it was 1947 before the American Water Works Association again took up the issue. The exigencies of World War II contributed to the lag, but no doubt so did Wolman's advice to proceed slowly in evaluating fluoridation as a public health measure. In the intervening 4 years, two major clinical trials of artificially fluoridated water had begun, as well as other studies in Brantford, Ont., in Sheboygan, Wis., and in Marshall, Tex. The public and groups of dentists in several areas were pressuring communities to conclude the experiments, which had been planned to run for at least 10 years, and to begin empirical fluoridation programs.[33]

The American Water Works Association, however, still had not come to any agreement about fluoridation in particular or, more generally, about what limits should be imposed upon treating water to suit human needs. Wolman, in fact, seemed even less certain that the profession should support fluoridation. At the association's 1947 meeting, he again addressed the assembly on the issue, this time in a talk entitled "Should the Public Water Supplies Be Used for Mass Medication?"[34]

Wolman still wished to call attention to what he perceived as differences between fluoridation and earlier modifications to water. This time, however, he did not distinguish between additions to water and the elimination of undesirable substances, as he had 4 years earlier. Rather, Wolman argued, the key difference between earlier water treatments and water fluoridation was that earlier treatments were aimed at treating *water* whereas fluoridation was aimed at treating *people.*

> Hitherto chemical additions, with minor exceptions, have been predicated upon the correction or modification of the quality of the water, with the primary intent of eliminating deleterious substances therefrom, or of modifying their character in such a way as to make the commodity safer, more palatable, or physically more attractive to the consumer, or softer. When we add a chemical to water for the frank purpose of introducing a medical substance to treat the consumer rather than to modify the water, however, we enter a different area of practice.[35]

It was still not an area into which Wolman felt comfortable leading engineers. He concluded his presentation with some "guiding principles" for waterworks personnel under public pressure to fluoridate, urging them to "avoid the use of public water supplies for medication," at least until experimentation was complete and there was consensus on fluoride's safety and efficacy. Even then, Wolman warned, "practices for treating the diseases of the people ... in ways other than through the community water supply should be thoroughly investigated from the professional and economic stand points. In general such alternative practices, inherently more specific in nature, are to be preferred."[36]



Abel Wolman at midcareer. Courtesy of the American Water Works Association.

Linn H. Enslow, during his term as American Water Works Association president. Courtesy of the American Water Works Association.

Wolman's cautious response to mounting pressure to fluoridate water supplies won him at least a few relieved supporters among waterworks personnel in the audience that day. In the discussion following Wolman's talk, San Francisco's director of public health noted that there were "already enough mass experiments and demonstrations being conducted on public water supplies," and he urged health officers to "prevent pressure by the general public for treatment of drinking water" with fluoride.[37] The superintendent of Seattle's water supply, noting that at the age of 73 he still had "all his own teeth," expressed concern over the possibility of lawsuits involving fluoridated water and remarked that it was "not good judgment, where safety is not involved, to treat 100 gallons of water for the sake of the 1 gallon used for human consumption."[38]

But if many waterworks engineers were in agreement with Wolman's cautiousness, others were not. M. Starr Nichols, professor of sanitary engineering at the University of Wisconsin, took issue with Wolman's use of the term *mass medication,* a phrase that antifluoridationists were beginning to use to characterize fluoride as coercive and inefficient, and with Wolman's "rather dark" attitude toward fluoridation.[39]

> In the author's opinion, if an accessory factor is added to a diet, either by the manufacturer or the consumer, the correct word to be used is "supplementation," or—if a still more attractive term is desired—the word "enrichment" might be borrowed from the flour manufacturers' vocabulary. Thus since fluorides are naturally present in certain waters and perform some function in the prevention of dental caries, they are not, at least in natural waters, medicaments.[40]

Worse than the terminology, however, to some emerging profession leaders was Wolman's apparent willingness to continue to fence-sit on the fluoridation issue. By 1948, at least nine cities were adding fluoride to their water in various types of studies.[41] It seemed to some that the fluoridation movement was already under way without waterworks engineers, an absence that was becoming increasingly conspicuous. In fact, since the focus in fluoride research had shifted from controlling excessive amounts to devising a means to reduce tooth decay, waterworks personnel had been only marginally involved; now, plans to add fluoride to community water supplies on a nonexperimental basis were taking shape without guidance from the American Water Works Association or, indeed, from waterworks engineers in general.[42] Oughtn't waterworks engineering be more involved in what was, after all, a public health measure centered on community water supplies?

Among those concerned that the association was not moving quickly enough on fluoridation was Linn H. Enslow, who in 1948 became the association's president. Enslow was a friend and former colleague of Wolman, the two having worked together on a controlled chlorination procedure in 1918 while working for the Maryland State Department of Health.[43] More recently the two had worked together on articles on water and sewage treatment. Enslow had become the editor of *Water and Sewage Works* in 1931, moving from an industrial research position at the Chlorine Institute.

As association president, Enslow wasted little time in taking on the fluoridation issue. When the association's board of directors, upon which Enslow served, convened for its annual meeting in January 1949, it appointed a Special Committee on Association Policy Regarding Fluoridation of Public Water Supplies, an ad hoc group made up of prominent waterworks personnel who were far less cautious about water fluoridation than was Wolman. Alvin P. Black, who earlier chaired the methods committee, was appointed policy committee chairman. Also appointed to the committee were Alvin E. Berry, who had already published on the potential of fluoridated water; Raymond J. Faust of the Michigan Department of Health, a strong proponent who had lobbied hard to encourage the Public Health Service to use Michigan for the first artificial fluoridation trials; W. Victor Weir, a prolific engineer from Missouri who had recently served with Faust on an association panel; and Harry A. Faber, a young colleague of Enslow's from the Chlorine Institute, who had written favorably, if obliquely, on water fluoridation for *Water and Sewage Works,* the publication Enslow edited.[44] H. Trendley Dean of the Public Health Service served as consultant to the committee, and Enslow served ex officio. The board also later appointed a standing committee to evaluate fluoride materials and methods, thus ensuring that some part of water fluoridation would be the exclusive purview of waterworks engineers.

Although Enslow wanted the association to act quickly on the fluoridation issue, he also wanted to minimize the chance that the profession would disagree with the rest of the public health community or become too openly divided on the question of fluoridation. Under increased public pressure, the Public Health Service, the American Dental Association, and the American Medical Association seemed likely to respond favorably to fluoride, but engineers were still raising cost and liability questions to which committee members Faust and Faber responded in some of their writings preceding the policy's release.[45] And beyond technical concerns lay the still unanswered ideological questions about the role of the profession in treating water to promote health.

To Enslow, approving fluoridation appeared to provide a world of opportunity for burnishing the profession's image. Enslow wrote an April 1949 editorial in *Water and Sewage Works* encouraging engineers to see water fluoridation "as a possible means of glamorizing water supply, thereby focussing public attention on water supply as no longer just the commonplace service which it has been taken to be much too long."[46] In fact, Enslow contended, fluoridation might provide "a means of softening the much needed rate increases."[47] If waterworks engineering was to benefit from the opportunity that fluoridation presented, Enslow believed the time to act was at hand:

> Whenever there develops a public demand for fluoride treatment, backed by local medical and dental opinion favor-

> ing the "experiment," it is our opinion that water utility management can ill afford to longer stand on the "watchful waiting policy" or to object on the grounds of added expense to the utility. The first will constitute bad public relations and the second should be easily resolved through a . . . rate increase which a public desirous of the protective treatment will gladly accept.

The American Water Works Association's Policy

Not surprisingly, Enslow's editorial presaged the committee's policy, which was presented to the association's board of directors the next month and adopted without incident. Committee chair Black presented the new policy to the association's body at the national meeting in June 1949:

> In communities where a strong public demand has developed and the procedure has the full approval of local medical and dental societies, the local and state health authorities, and others responsible for communal health, water departments may properly participate in a program of fluoridation of public water supplies.[48]

It was one sentence, but it was skillfully crafted and it made a sensation at the meeting and afterwards. The published report of the committee received the Goodell Prize, one of the association's highest awards, in 1950 for "the most notable contribution to the science or practice of water works development," and committee members Black, Berry, and Weir followed Enslow as the association's next three presidents while Faust went on to become the executive assistant secretary to the organization.

The board and the committee clearly hoped that the swift adoption of the policy—making the association the first national organization to have such a policy—would stem the impression that water fluoridation studies and initiatives were proceeding apace without much input from waterworks engineers and that a major public health initiative was under way without them. "The water supply industry has always been progressive in matters pertaining to public health and welfare," observed the committee in the statement that accompanied the policy. "It has initiated extensive research pertaining to water quality and has been prompt to adopt new procedures and techniques when these have been found to improve the quality of public water supplies."[49]

Carefully chosen words and phrases in the policy served to negotiate several areas of concern surrounding water fluoridation. For example, stating that engineers "may properly participate" in fluoridation rather than mandating them to do so defused resentment or mutiny on the part of waterworks engineers who had not yet made up their minds on the issue and felt embattled by growing pressure to fluoridate. Similarly, the policy's limitation to those "communities where a strong public demand has developed" allowed waterworks engineers to stand pat where there was, after all, no opportunity to create good relations with the public or with public health authorities. If it is not an issue in your community, the policy reassured waterworks engineers, you don't have to make it one.

Most significantly, however, the policy omitted waterworks engineers in the list of those "responsible for communal health." By stressing the role of other authorities in making the fluoridation decision—as Enslow had also done in his April 1949 editorial—the policy also no doubt sought to mollify those who still felt the association should wait to approve the measure or who were emerging as opponents of fluoridation. But in so doing, the fluoridation policy had another, unintended consequence: it made waterworks engineers the servant—not the partner—of the public health officials involved in water fluoridation, a role that persists today and has extended beyond the issue of fluoridation into pollution and disease control, and water policy and management. The committee sought to neutralize a potentially divisive issue by locating authority for fluoridation outside the profession, but in relinquishing that authority, the profession conceded a great deal of the status and prestige of association with decision-making roles in public health. Thus, the very efforts to ensure that waterworks engineers were not left behind in this new public health measure were themselves partly responsible for the passive, unequal role to which waterworks engineers were ultimately assigned.

In 1951 the board reaffirmed its policy, noting that "the past two years have shown the position to be sound." The statement accompanying the reaffirmation made explicit the new role for waterworks engineers: "Recommendations for fluoridation are the prerogatives of the dental, medical, and public health groups. When the proper authorities approve the treatment, it then becomes the function of the water works utility and industry to follow through willingly and intelligently."[50] Association leaders may have hoped that a reaffirmation might include a stronger profluoridation statement, following the policies that had recently been adopted by the American Dental Association, the APHA, and several other national organizations. Policy Committee Chair Black, for example, wrote that the policy represented a "tentative approach" to the problem: "[T]he issue is not closed, but only joined."[51]

However much some would have liked to make a stronger statement, though, the threat of dissent still loomed within the ranks of waterworks engineers, who, individually and in local sections, continued to question and, on occasion, oppose water fluoridation on technical and ideological grounds. The New Jersey section of the association voted to oppose fluoridation in the state "and then found itself in the unenviable position of having its warning flatly rejected by the State Public Health Council."[52] The Atlantic City water superintendent led that city's opposition to fluoridation in the early 1950s, noting that fluoride would be added to water "not by physicians or chemists but by laborers with shovels."[53] New York City's commissioner of Water Supply, Gas, and Electricity testified against fluoridation at hearings in 1957. "Benefit in reducing tooth decay has been greatly exaggerated," he maintained. "Actually fluoridation merely delays tooth decay for two years."[54]

Conclusions

Abel Wolman eventually became a strong advocate of fluoridation, serving in the 1950s on a National Research Council investigation of the issue and promoting it in his capacity as consultant to the city of Baltimore and the state of Maryland.[55] His change of heart was "the result of a long period of gestation," as he told an oral historian in 1981, adding, "[w]hen I monkey with the universe I'm cautious."[56]

Wolman's reputation was unaffected by his early position on fluoride; he continued to serve the association in a variety of ways and received an association award for distinguished public service in 1952.[57] He also continued to rank among the most respected public health figures of the century, with a career that spanned more than 60 years.

Late in his life, Wolman lamented the diminished role of waterworks and other sanitary engineers in public health. In 1977 he wrote an *ubi sunt* piece in which he examined "the fate and disappearance of a distinguished professional

discipline, generally known as sanitary engineering and peculiar to the U.S."[58] In a tone that bordered on peevish, the usually gracious Wolman took issue with the "new high priests of environmental protection," accusing them of peddling old wine in new bottles.[59] "Some rediscoverers of the wheel may be chagrined to learn that beginning nearly sixty years ago papers appeared on the sanitation of industrial water supplies, investigations of disinfection of water . . . and more," wrote Wolman. Unlike contemporary professionals who "are impelled to jump from one bandwagon to another," the "sanitary engineer was . . . a fabricator of change."[60] Alas, however, "like the dinosaur" he has gone "the way of all flesh, and now masquerades under such titles as ecologic advisor, environmental engineer, [and] biosphere evaluator."[61]

It would be ironic if Wolman, who always spoke so persuasively about the role of waterworks engineers in advancing community health, had in some way been responsible for limiting the role of the profession in making decisions about the public water supply. But Wolman's "watchful waiting" position on fluoridation was based less on the idea that the special knowledge of waterworks engineers could in the fullness of time be brought to bear on the issue than it was on an inherent cautiousness about both the water supply and the waterworks profession. The decision to fluoridate, he told an oral historian, "should not be made by the water works man, [but instead] by the medical profession with the best of epidemiological human evidence."[62] Thus, his arguments for the broad social utility of waterworks engineering were undermined by his failure to see just how large the issue of fluoridation loomed for the profession and by his consequent advice to move slowly.

As Wolman suggests, water has continued to be an important focal point for public health initiatives; it is, in fact, increasingly hotly contested professional terrain (if water may be termed "terrain"). Yet waterworks engineers have moved away from decision-making roles in water supply issues, and today waterworks engineering is not a profession that pins much of its reputation on fabricating change.

Where indeed are the waterworks engineers of yesteryear? The answer may in part lie in the profession's response to fluoridation, for there we may see the profession caught between the rock of Wolman's cautiousness and the hard place of Enslow's feeling that it was far safer to cede authority for policy decisions over the water supply to doctors, dentists, administrators, and even the lay public than to enter the growing political fray surrounding fluoridation.

For professions, the struggle to maintain authority and status is enacted not simply in the tasks at hand but also in the asking of (and in the timely attempt to answer) broad ideological questions about the profession's jurisdiction. And even though it might hold some academic interest to us now to see which direction waterworks engineers decided to steer water treatment—whether they emerged as tight-lipped guardians of the purity of human essence or in fact rode the waves of social demand (and might now be offering water both fluoridated and plain, or even the dazzling array of water beverages now marketed privately)—the specific answers to broad questions matter less than the fact of the grappling with them. Waterworks engineers were never guided to consider the questions posed midcentury about the limits of treating public water supplies to meet human need, and when they failed to respond, other groups spoke right up.

Professional groups involved in public health today find an even more politically charged atmosphere than did waterworks engineers at midcentury. Gun control, gender equity in clinical trials, and the spread of acquired immunodeficiency syndrome are health problems with significant, if not overshadowing, political and ideological facets. The fate of waterworks engineers holds a lesson for those groups who think the safest course is to steer clear of broad questions and political hot spots. Such conservatism has risks of its own and, as in the case of waterworks engineering, can lead to professional extinction. □

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3. M.N. Baker, *The Manual of the American Water-Works* (New York, N.Y.: Engineering News Publishing, 1897), i.
4. "Sanitary engineering" was an umbrella under which stood engineers of a wide variety of backgrounds and work sites. Others who called themselves "sanitary engineers" included municipally employed engineers in street departments and departments of public works; civil, hydraulic, and mechanical engineers whose work involved the development of infrastructure related to disease prevention; and engineers working for state governments in the area of disease prevention.
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6. For a discussion of the idea of professional jurisdiction and its relationship to professional structure, see A. Abbott, *The System of Professions* (Chicago, Ill.: University of Chicago, 1988), especially 1–31.
7. Tarr, "Disputes over Water Quality Policy," 431.
8. Nor, for that matter, was everyone in the profession an engineer. Because the waterworks profession was built around a particular set of tasks—supplying safe, palatable, economical water to communities—more than around a certain job title, its associations were also open to chemists, bacteriologists, water superintendents and commissioners, plant managers, and public works officials who wished to join. The leadership of the waterworks profession, however, was generally drawn from those in the highest-status positions, generally engineers whose work involved more research than practice; this is typical for professions.
9. For this wonderful turn of phrase, I am grateful to an anonymous reviewer of this paper, who also reminds me that one of the greatest pop culture symbols of middle-class banality was radio's Great Gildersleeve, bombastic water commissioner of the fictional town of Summerfield.
10. Abbott, *The System of Professions.*
11. C.K. O'Toole, *The Search for Purity: A Retrospective Policy Analysis of the Decision to Chlorinate Cincinnati's Public Water Supply, 1890–1920* (New York, N.Y.: Garland, 1990): i. On the shift from watershed protection to water treatment, see Tarr, "Disputes over Water Quality Policy" and

George W. Fuller et al., "An Informal Discussion at the Annual Convention, July 10th, 1907," in *Pure and Wholesome: A Collection of Papers on Water and Waste Treatment at the Turn of the Century* (New York, N.Y.: American Society of Civil Engineers, 1982).

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14. L.F.G. Bouscaren, "A Pure Water Supply for Cincinnati," quoted in C.K. O'Toole, *The Search for Purity,* 1. See also Fuller et al., "An Informal Discussion at the Annual Convention," in *Pure and Wholesome,* 39–73.
15. See, for example, the discussion by George C. Whipple in *The Value of Pure Water* (New York, N.Y.: John Wiley and Sons, 1907), particularly 2–3.
16. Fuller et al., "An Informal Discussion at the Annual Convention," 44, and E.S. Chase, "Progress in Sanitary Engineering in the United States," 14 in *Pure and Wholesome.*
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41. H.A. Faber, "Shall Fluoride Be Added to Public Water Supplies?" *Water and Sewage Works* 95 (November 1948): 396. The cities were Grand Rapids and Midland, Mich.; Madison and Sheboygan, Wis.; Newburgh, N.Y.; Evanston, Ill.; Ottawa, Kan.; Marshall, Tex.; and Brantford, Ont.
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